

Analysis of street names regarding the designation of cities

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Abstract. “Everything is related to everything else, but near things are more related than distant things.” (Tobler 1970) This citation, known as Tobler’s first law of geography, is a well-recognised law within spatial science for analysing and describing spatial correlations. Motivated by this, we suggest that correlations between cities would be reflected in street names. Our research objective is the analysis of patterns and relations underlying the designation of European cities within German street names. Furthermore, we evaluate the spatial distribution of streets on the British Isles named after British and Irish towns. We investigate if the designation of cities and towns in street names is only determined by spatial proximity (Tobler’s law) or if other factors (e.g. importance) influence the frequency of street names as well. Here, the central place theory by Christaller (1933) is considered. Christaller emphasized a hierarchical structure of places. Every place has a certain degree of importance, but central places of a higher order have more amenities and thus a surplus of importance. Applied to street names, it can be assumed that important cities are termed more frequently.

OpenStreetMap was used as initial data for the analysis. All streets within Germany which are named after any European city were selected. Therefore, a list of all cities with more than 100,000 inhabitants was used as a gazetteer and ambiguities were revised. The revision was carried out interactively to assess ambiguities of streets with names of other places, rivers, or persons in the spatial context. In many cases, semantic similarity exists between adjacent streets which refer to places of the same region. Based on the selected streets, the geospatial distribution of streets named after each city is determined automatically. It was possible to define, for example, where there is a “Pariser Platz” (Paris Sq), “Pariser Straße” (Paris St), or “Pariser Ring” (Paris Cir). The specific distribution patterns were analysed regarding the theories of Tobler and Christaller.

As a result of the analysis, a distribution according to Tobler's law could be found, especially for smaller cities where their names occur primarily in municipalities located nearby (Fig. 1a-c).

The influence of spatial proximity according to Tobler is superimposed by other factors like the degree of importance. Cities with a surplus of importance (Christaller's theory) are more frequently named in street names. Their spatial distribution is widely spread. Examples are London, Paris, and Prague whose distributions can be seen in figures 2a-c. Their names occur in many German streets, but the density of streets named after one of them increases with a closer distance to the respective city.

In addition to our expectations, political motivation is a dominating factor in street naming and influences the frequency and distribution of specific street names. Former German cities like Wrocław, Kaliningrad, or Gdańsk (Fig. 3a-c) are widely referred to in street names in Western Germany; they rarely occur in Eastern Germany. The same applies to Eastern German cities. They are frequently mentioned in Western German streets, while Western German cities occur less often within Eastern Germany. This inhomogeneity between street naming in Western and Eastern Germany can be explained by different political attitudes after WW2.

The influencing factors, but principally the political factor, can also be seen in Figure 4. Here, the ratio of streets in Germany named after European cities of one NUTS-1-region and the number of referred cities within these regions is shown. Eastern German and former German cities are frequently mentioned in German streets names. Furthermore, important European cities, e.g. London or Paris, are often named as well. The influence of spatial proximity is proved by the decreasing frequency of street names after cities with an increasing distance between the city and Germany.

Other influencing factors like bilateral or historical relations of cities (town twinning, university cooperation or connection via transport axis) are relevant only for selective cities and can be seen as noise.

In analogy with the analysis of German street names, the methodology was also applied on British and Irish streets. Here, all streets that are named after one of the five most referenced towns of each country were selected and their spatial distributions were analysed (Fig. 5).

Tobler's law could also be approved here. Streets named after towns of a specific country arise more often within the country they refer to. For example, about 81% of all streets in England named after British or Irish towns relate to an English town. Likewise, 62% of the streets in Scotland are named after Scottish towns and 64% in Ireland refer to Irish towns. Furthermore, streets are more often named after towns of adjacent country.

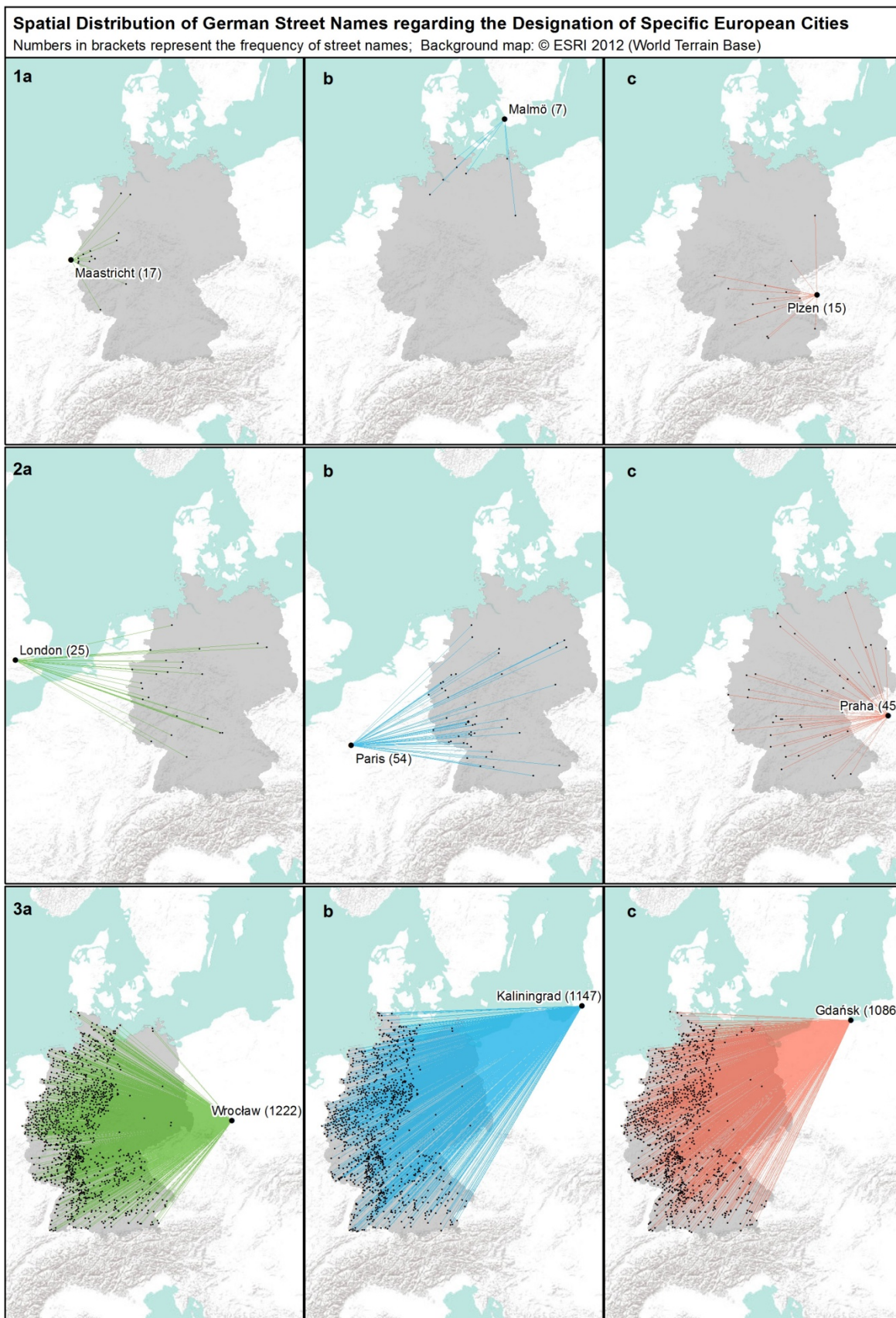
For instance, Welsh towns are named in 3% of English streets, but they occur less often in Scottish or Irish streets and not at all in Northern Ireland. Alike, Scottish towns are primarily named in streets of England and Northern Ireland and less frequent in Ireland and Wales. It can also be seen in the relations of Ireland and Northern Ireland. 16% of Northern Ireland's streets are named after Irish towns and reversely 7% of Irish streets referencing towns of Northern Ireland.

Superimposed by the spatial proximity, other influencing variables occur. Also towns with a surplus of importance are more frequently named in street names. Because England has a higher density of cities and towns with surpluses of importance, English towns are commonest in street names all over the British Isles.

The political and historical influence for example can be seen in the relations of England and Scotland. 67% of all streets named after Scottish towns are located in England but reversely only 3% of all streets referencing towns in England can be found in Scotland. There are 13 "London St" in Scotland, nevertheless, 35 "Inverness St" in England (making 90% of all streets named after Inverness). Despite of the fact that Inverness is nowadays minor and has less surplus of importance compared to London.

Summarizing, the anticipated spatial patterns could be identified; although, the political factor has important influence and is dominant for selective cities. It is assumed that political influence on street can also be expected outside Germany. We assert that it can also be reflected in other applications of GIR. The results are usable, for example, for solving ambiguous street name issues: "Breslauer Straße" (Wrocław St) in Frankfurt refers to Frankfurt (Main) with a higher chance than to Frankfurt (Oder), although the latter is closer to Wrocław.

Keywords: Geospatial Analysis, Geographical Names Database, Geostatistics, OpenStreetMap, Political Maps, Street Naming



Figures 1-3. Spatial Distribution of German Street Names Regarding the Designation of Specific European Cities

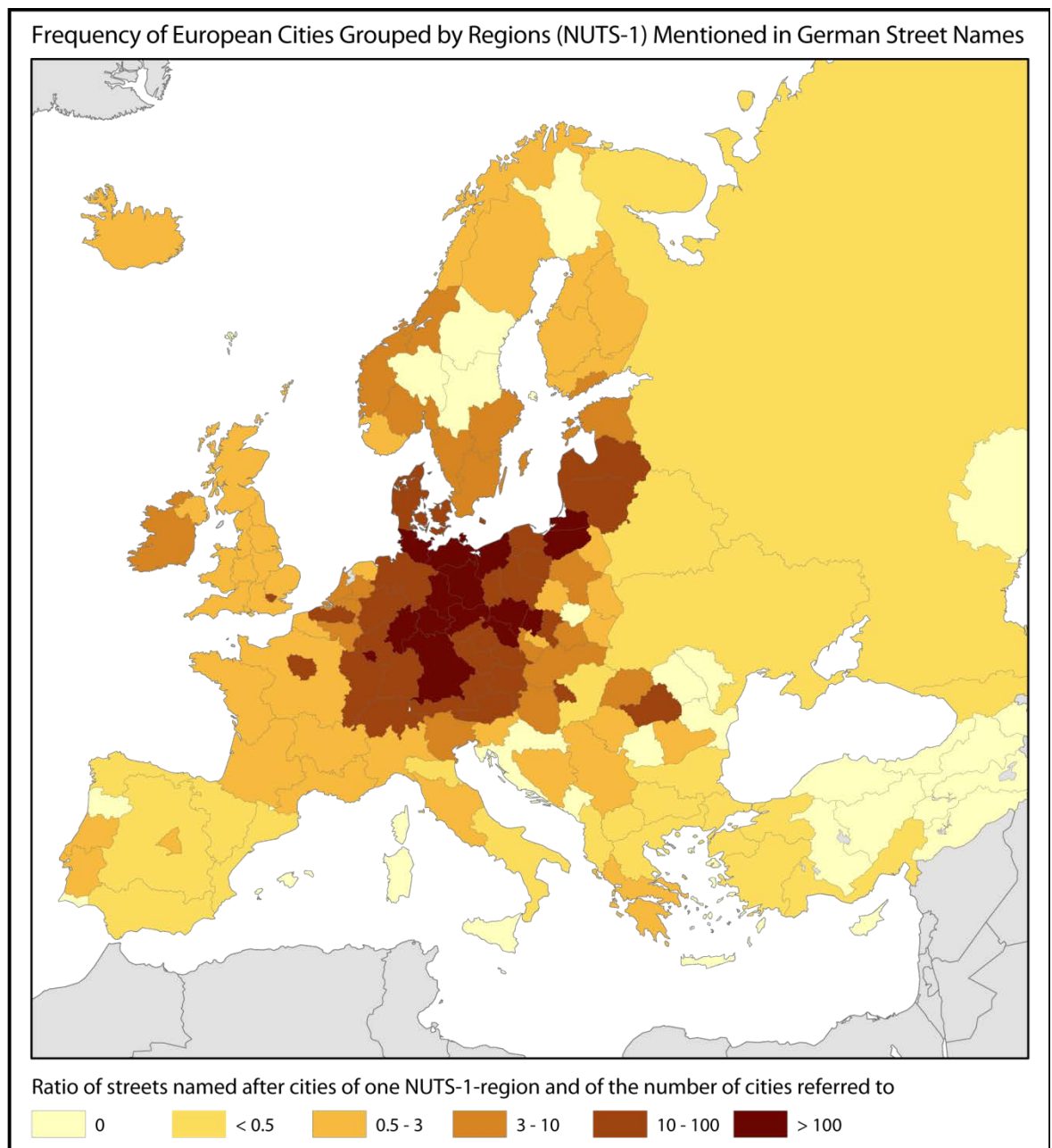


Figure 4. Frequency of European Cities Grouped by Regions (NUTS-1) Mentioned in German Street Names

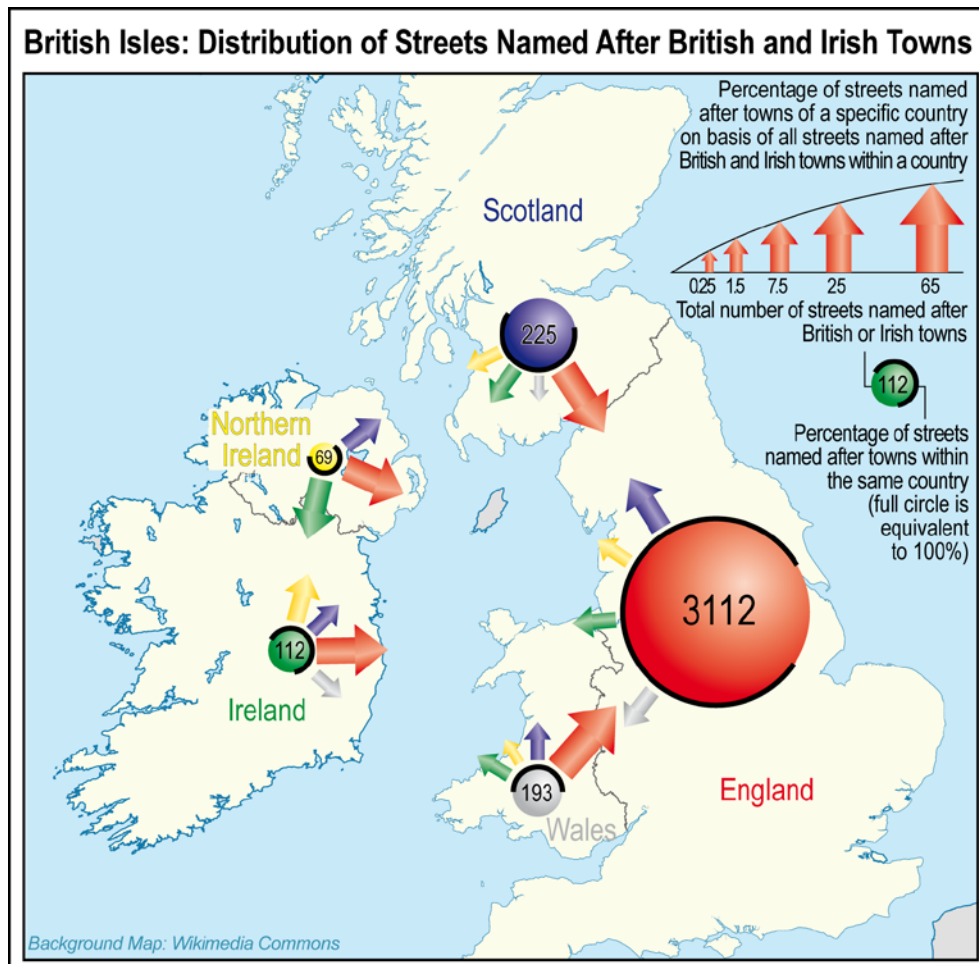


Figure 5. Spatial Distribution of Streets on the British Isles Named After British and Irish Towns

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